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DAFTAR PUSTAKA

Abrar, S.W., Mendhe, V.A., Kamble, A.D., Shukla, P., Sharma, P., Buragoahin, J., Kumari, S., Kumari, S., Anurag, Das, A.K., Kumari, M., Subbaraidu, S., Bordoloi, A., 2025, *Cleat* and Fracture Systems in Coal with Implications for Strength, Hydrofracking, and Gas−Water Flow Mechanisms, A Critical Review: ACS Omega, v. 10 (28), 29909-29928. https://doi.org/10.1021/acsomega.5c00520

Aguilera, R., 1995, Fracture Porosity and Permeability, *Natural*ly Fractured Reservoirs, (second edition): Oklahoma, PennWell Books, 528 p.

Amijaya, D.H., and Littke, R., 2005, Microfacies and depositional environment of tertiary Tanjung Enim low rank coal, South Sumatera Basin, Indonesia: International Journal of Coal Geology, v. 61, p. 197-221.

Apriyani, N., Suharmono, Momen, M., Djaelani, S., Sodli, A., Satria, A., Murtani, A.,S., 2013, Integrated *Cleat* Analysis and Coal Quality on CBM Exploration in Sangatta II Field, Kutai Basin, East Kalimantan, Indonesian Petroleum Association, v. 37.

ASTM International, 2015, Standard Classification of Coals by Rank, ASTM D388-15: West Conshohocken, ASTM International, p. 1-3.

Barber, A.J., Crow, M.J., and Milsom, J.S., 2005, Sumatra: Geology, Resources and Tectonic Evolution: London, The Geological Society, 304 p.

Beaton, A., 2003, Production Potential of Coalbed Methane Resources in Alberta, Energy and Utilities Board, EUB/AGS Earth Sciences Report 2003, v. 03.

Candra, A., 2013, Potential Evaluation of Coalbed Methane Based on the Grade and Quantity of the Coal in the Mangus *Seam*, Muara Enim Formation, Nibung Area, South Sumatra Basin, 37th Annual Convention & Exhibition: Indonesian Petroleum Association (IPA), Abstracts.

De Coster, G.L., 1974, The Geology of Central and South Sumatra Basins, Third Annual Convention: Indonesian Petroleum Association, Jakarta, p. 77-110.

Diessel, C.F.K., 1992, Coal-Bearing Depositional System: Newcastle, Springer, 727 p.

Fisk, J.C., 2010. Correlating Deliverability to Lithology, Faults, Fracture and *Cleat*s in Coalbed Methane Exploitation. Thesis of a Master of Science student at the University of Oklahoma, Oklahoma, (Unpublished).

Gao, L., Mastalerz, M., and Schimmelmann, A., 2020, Origin, Geology, and Reserve for CBM Reservoirs, in Thakur, P., Schatzel, S.J., and Aminian, K., eds., Coal Bed Methane, Theory and Application (second edition): Amsterdam, Elsevier, p. 3-112.

International Gas Union, Snam, and Rystad Energy, 2025, Global Gas Report 2025: https://www.snam.it/content/dam/snam/pages-attachments/it/investor-relations/documents/scenari/global-gas-report/Global_Gas_Report_2025.pdf.coredownload.pdf (Accessed November 2025).

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Juniarto, R., Capah, A.I.G., Hisan, N.K., 2020, Perhitungan Gas Content Berdasarkan Formula Kim pada *Seam* Batubara Formasi Muara Enim, Jurnal Teknologi dan Inovasi Industri (JTII), v. 1(2), p 22–26. https://doi.org/10.23960/jtii.v1i2.20

Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, 2012, Tata Cara Penetapan dan Penawaran Wilayah Kerja Minyak dan Gas Bumi Non Konvensional, Peraturan Menteri Energi dan Sumber Daya Mineral Republik Indonesia Nomor 05 Tahun 2012: Jakarta, KESDM, 38 p.

Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, 2024, Laporan Kinerja Badan Geologi Kementerian Energi dan Sumber Daya Mineral: Bandung, KESDM, 161 p.

Laubach, S.E., and Tremain, C.M., 1991, Regional Coal Fracture Patterns and Coalbed Methane Development, Thirty second U.S. Symposium on Rock Mechanics: Rotterdam, A.A Balkema, p. 851-859.

Laubach, S.E., Marrett, R.A., and Olson, J.E., Scott, A.R., 1998, Characteristics and Origins of Coal *Cleat*: International Journal of Coal Geology, v. **35**, p. 175-207.

Law, B.E., 1993, The Relation Between Coal Rank and *Cleat* Spacing: Implication for the Prediction of Permeability in Coal, International Coalbed Methane Symposium. v. 2, p. 435-442.

Leidecker, M.V., Mosser, M.H., 2020, Production Engineering for Coal Bed Methane, in Thakur, P., Schatzel, S.J., Aminian, K., eds., Coal Bed Methane, Theory and Application (second edition): Amsterdam, Elsevier, p. 337-340.

Lessy, I.D., 2016. Hubungan Atribut *Cleat* dengan Kualitas dan Nilai Permeabilitas pada Batubara Anggota M2 Formasi Muara Enim, Lapangan Tanjung Enim, Cekungan Sumatera Selatan. Tesis mahasiswa Teknik Geologi Universitas Gadjah Mada, Yogyakarta, (Unpublished).

Muhartanto, A., and Iskandar, E., 2006, Penentuan Peta Sebaran Potensi Gas Metana Batubara (Sweet Spot Area) di Daerah Bukit Asam, Sumatra Selatan: Jurnal MINDAGI, v. 10(1), p. 27-54.

Nelson, R.A., 2001, Geologic Analysis of *Natural*ly Fractured Reservoir (second edition): USA, Gulf Professional, 350 p.

PT Bukit Asam Tbk, 2007. Laporan Geologi Tahun 2017. Laporan Internal Pemboran Eksplorasi dan Geophysical Logging, Satuan Kerja Unit Eksplorasi Rinci, (Unpublished).

PT Bukit Asam Tbk, 2025, Kinerja Operasional Terjaga, Bukit Asam (PTBA) Bukukan Laba Rp1,4 Triliun sampai dengan 30 September 2025: https://www.ptba.co.id/api/storage/1761817689422-a4a49f13-164c-4b30-a1a2-27098624b60e.pdf
(Accessed November 2025).

Pulunggono, A., Haryo, A.S., and Kosuma, C.G., 1992, Pre-Tertiary and Tertiary fault systems as a framework of the South Sumatra Basin: A study of SAR-maps, Twenty First Annual Convention: Jakarta, Indonesian Petroleum Association, p. 339-360.

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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Putri, I.P., Pitulima, J., and Mardiah, 2019, Evaluasi Kualitas Batubara dari Front Penambangan Hingga Stockpile di Pit 1 Banko Barat PT Bukit Asam Tbk Tanjung Enim (Evaluation of Coal Quality from Mining Front to Stockpile at Pit 1 Banko Barat PT Bukit Asam Tbk Tanjung Enim): Jurnal MINERAL, v. 4(1), p. 1-7.

Priest, S.D., 1993, The Collection And Analysis Of Discontinuity Orientation Data For Engineering Design: International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts, v. 3, p. 167-192.

Saghafi, A., and Sosrowidjojo, I.B., 2009, Development of the first coal *seam* gas exploration program in Indonesia: Reservoir properties of the Muara Enim Formation, South Sumatra: International Journal of Coal Geology, v. 79, p. 145-156.

Sapiie, B., and Rifiyanto, A., 2017, Tectonics and Geological Factors Controlling *Cleat* Development in the Barito Basin, Indonesia: Journal of Engineering and Technological Sciences, v. 49(3), p. 322-339.

Scott, A.R., Kaiser, W.R., and Ayers Jr, W.B., 1994, Thermogenic and secondary biogenic gases, San Juan Basin, Colorado and New Mexico - implications for coalbed gas producibility: AAPG Bulletin, v. 78(8), p. 1186-1209.

Seidle, J., 2011, Fundamental of Coalbed Methane Reservoir Engineering: USA, Pan Well Corporation, 415 p.

Shell Mijnbouw, N.V., 1976. Geological study of the Bukit Asam coal mines. Laporan internal/arsip teknis PT Bukit Asam Tbk, Jakarta, (Unpublished).

Sloss, L. L., 2015, Potential for Enhanced Coalbed Methane Recovery, IEA Clean Coal Centre, 41 P.

Speight, J.G., 2005, Handbook of Coal Analysis: New Jersey, John Wiley & Sons Inc, 212 p.

Thakur, P., Schatzel, S.J., and Aminian, K., 2014, Coal Bed Methane: From Prospect to Pipeline (first edition): Amsterdam, Elsevier, 435 p.

Thomas, L., 2020, Coal Geology (third edition): UK, John Wiley & Sons Ltd, 520 p.

United States Army Corps of Engineers, 2014, Engineering and Design: Methods to Identify Optimum Drilling Direction for Geotechnical Exploration and Rock Engineering, Engineer Technical Letter (ETL) No. 1110-2-581: Washington, D.C., United States Department of the Army, 152 p.

Virginia Center for Coal and Energy Research, 2011, A Regional Handbook for Coalbed Methane Degasification in the Southern Shanxi Province, China, US Environmental Protection Agency, 98 P.

Wang, H., Zhang, S., Zhang, X., Huang, H., Wang, J., 2021, Numerical Simulation Research on Well Pattern Optimization in High-Dip Angle Coal *Seam*s, A Case of Baiyanghe Block: Frontiers in Earth Science, v. 9, A 692619.
doi: 10.3389/feart.2021.692619

Weniger, S., Weniger, P., Littke, S., 2016, Characterizing Coal *Cleat*s From Optical Measurements For CBM Evaluation: International Journal of Coal Geology, v. 154-155, p. 176-192.
http://dx.doi.org/10.1016/j.coal.2015.12.005